Efficient Single-Mode Light Generation with Prisms Meant for Confusing LiDAR

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Introduction

Although existing single-mode LASER generation methods are adequate for most applications, those methods leave much to be desired in terms of efficiency.

Abstract

Currently, single-mode (single-frequency) LASER light is generated by use of waveguide mechanisms. There are many extant waveguide mechanisms; some more efficient than others. Profoundly, the prevalent mechanisms of today for generating single-mode light involve starting with light of a variety of wavelengths and filtering out all modalities of light that have a wavelength that is longer or shorter than the desired wavelength. The use of this approach means that most of the energy generated is wasted and that the net output, although of high purity (i.e. has a low M value) is a fraction of the total light generated. The mere use of the term "waveguide" to describe this sort of mechanism is a misnomer since such a mechanism is a frequency filtering mechanism and not a frequency modification mechanism.

In August, I developed a concept for enabling a re-entry vehicle or other craft to evade detection by existing LiDAR systems by equipping those vehicles with a skin made of crystals that normalize (or uniform) the multi-spectral light emitted by a seeker head in an interceptor. The receiver in an interceptor would be confused by a return that consists of only a single frequency of light and this type of distortion would send an interceptor veering off-course.

In developing this concept, quite by accident, I had unwittingly overcome a longstanding problem in optics concerning single-mode light generation. Single-mode LASERs tend to become overheated and tend to be deficient in net output. The mechanism I had developed to defeat LiDAR I had developed turned out to be a crucial component for improvement of the very LiDAR I had developed 14 years ago; the better of any commercially available design in use, even to this day.

Although more efficient single-mode LASERs have many applications, one of those applications is in constructing prismatic LiDAR with improved range. As useful as my own single-to-multi mode concept is for creating point clouds from a single beam with millions of point-specific frequencies, for this approach to work, a single-mode LASER light of sufficient power must always be the first ingredient. If you wish to know more about the single-to-multi prism I designed, please see the archives.

The ideal single-mode generation method is one that wastes none of the initial light generated and, rather than filtering non-compliant frequencies, morphs

all light into the desired frequency. The frequency normalization crystal is the ideal mechanism for achieving this longstanding goal.

Rather than discarding any light that doesn't perchance conform, the normalization crystal uses double-node crystal junctions with the north poles of the paired nodes pointing inward and the south poles pointing outward. While there is a very short distance between the near-set nodes, each set of double-nodes is spaced relatively far from the next. The distance between individual keyholes or 'sweet spots' in the center of each double-node determines the frequency of the normalized light. Any light that is of too long of a wavelength has its frequency gradually stepped up by the magnetism of the nodes and any light that has too short of a wavelength would have its wavelength stretched with each undulation until finally all of the light comes to reliably pass within keyholes and none of the light does not. This method would allow nearly all of the initially emitted light to be morphed into a useful state; i.e. it has been uniformed. This method is clearly distinct from and superior to any approach based upon discarding the vast majority of generated light and can truly be termed a "waveguide."

Conclusion

It is my assertion that what we have here is not simply a clever means of sneaking through missile defense, but also a landmark advancement in single-mode light generation that has broad implications for the field of optics generally, including within the area of LiDAR design, itself.